# FOR THE POST OF RESEARCH OFFICER AND

# RESEARCH ASSISTANT IN THE OFFICE OF THE COMMISSION

## STATISTICS AND COMPUTER SCIENCE

## (PG DEGREE STANDARD)

**SUBJECT CODE: 307**

## STATISTICS

### UNIT – I: PROBABILITY THEORY AND DISTRIBUTIONS

Sample space and events, Probability measures and probability space-Random variables, Discrete and Continuous random variable, probability density and distribution functions. Simple theorems on Probability. Marginal and conditional distribution, Expectations and moments, Independence of events, Moments and Cumulants generating functions.

Discrete Uniform Binomial, Multinomial, Poisson, Negative – Binomial, Hypergeometric Distributions. Uniform, Normal, Cauchy, Beta, Gamma, Log Normal, Exponential, Weibull distributions, Chi square, t and F distributions.

### UNIT – II: STATISTICS INFERENCE

Point estimation – Interval estimation – Properties of estimate – consistency, Unbiasedness  efficiency sufficiency and Completeness, Fisher – Neyman Factorisation and Rao – Blackwell Theorems, Lehman – Scheffe theorem, Cramer – Rae inequality, method of maximum likelihood estimate and its properties, method of moments, method of minimum chi-square.

Simple and Composite Hypothesis, two kinds of error, power functions, most powerful test, Neyman – Pearson Lemma UMP and unbiased test, MLR property and its use for construction of UMP tests, Likelihood ratio test, confidence intervals for large and small samples.

Run test for Randomness, Median test, sign test for location, Wilcoxon – Mann Whitney U – test and Kolmogrov – Smirnov tests.

### UNIT – III: LINEAR MODELS AND DESIGN OF EXPERIMENTS

Theory of Least squares, classification of linear models, Best linear unbiased estimators (BLUE) for Gauss – Markov Conditions – Estimable functions, Test of linear hypothesis and its applications to ANOVA, Regression diagnostics.

Principles, CRD, RBD, LSD, RBD with many observations per cell, missing plot technique, fractional experiments 2'' and 3'' design. General theory of partial Confounding and fractional replication, analysis of Split plot, BIBD and PBIBD.

### UNIT – IV: MULTIVARIATE ANALYSIS

Multiple and partial correlations, Regression, Marginal and Conditional Distribution functions, MLE of mean vector and dispersion matrix for multivariate Normal. Mahalonobis D2 and Hotelling T2 Statistics and their applications (Excluding derivation of distributions) Fisher's Discriminant analysis, Wishart Distribution (Excluding Derivation of distribution) and its properties. Factor analysis and Principle Component analysis.

### UNIT – V: SAMPLING THEORY

Simple random sampling systematic and stratified sampling, PPSWR and PPSWOR methods of sampling, Hansen-Hurwitz, ordered and unordered estimators, Ratio and Regression estimates, Double sampling, Cluster sampling, Two stage and Multistage sampling Multi-phase sampling. Sampling and Non-Sampling errors. Randomized response techniques Organization of sample surveys, Sample survey organisation – CSO and NSSO.

### UNIT – VI: STOCHASTIC PROCESSES AND OPERATIONS RESEARCH

Concepts, homogeneous discrete time markov Chains-illustrations. TPM Classification of states and chains, higher transition probabilities, stability of Markov Chain, limiting behaviour, one Dimensional Random Walk. Chapman-kolmogrov equation, Ergodic theorem, Poisson Processes and related distributions, Birth Processes, Death Processes, Birth-Death Processes.

Linear Programming-Simplex procedure, Transportation and Assignment problems, Duality, Dual simplex, Game Theory, Single and Multi period inventory Models, Queuing Models – Waiting time distributions of M/M/1, M/M/D Models with different service policy, Service time distributions.

## UNIT – VII: STATISTICAL QUALITY CONTROL

Concepts of quality and meaning of Control, Different types of Control Charts like X bar, R, p and np charts and their uses. CUSUM chart. Sampling inspection Vs 100 percent inspection, single, double, multiple and sequential plans for attributes. Variable sampling plan. The OC, ASN, ATI and AOQ Curves, concept of producer's risk and consumer's risk, AQL, LTPD, AOQL, IQL, MAPD and MAAOQ.


## COMPUTER SCIENCE
## UNIT- VIII: FUNDAMENTALS OF COMPUTING

Introducing Computer Systems - Communicating with the Internet - Video and Sound - Transforming Data Into Information - Operating System Basics - Networking Basics - Database Management Systems - Creating Computer Programs - Pseudo code - Flow Chart and Algorithms.

## UNIT - IX: OFFICE MANAGEMENT TOOLS

**MS-Word:** Introduction to MS-Word and User Utilities - Exploring Template and Formation of Documents - Table handling - Mail Merge and Print Process.

**MS-Excel:** Spreadsheet - Workbook window - Formatting Cells / Worksheet - Working with Formula, Function and Charts - Filtering Data and Printing a Presentation.

**MS-Power Point:** Introduction to MS-Power Point - Creating Templates - Font and color editing - Adding Multimedia effects.

## UNIT – X: PROGRAMMING C

Overview of C – Constants - Variables and Data types - Operators and Expressions - Managing Input and Output Operations - Decision Making - Branching and Looping - Arrays Handling of Character Strings - User Defined Functions - Structures and Unions – Pointers - File Management in C.

Dated: 19.09.2017

**FOR THE POST OF RESEARCH OFFICER AND**

**RESEARCH ASSISTANT IN THE OFFICE OF THE COMMISSION**

**MATHEMATICS AND ECONOMICS**

**(PG DEGREE STANDARD)**

**SUBJECT CODE: 308**

**MATHEMATICS**

### UNIT – I: ALGEBRA

Group - examples - subgroup - Normal subgroups - homomorphisms - Isomophism - Cayley's theorem - Cauchy's theorem - Sylow's theorem - Finite ablian groups -Rings Euclidean rings - Polynomial rings - Polynomial over the rational field - Polynomials over Commutative rings - modules. Division rings - Frobenius theorem. Field: Finite fields - Wedderburn's theorem, Extension Fields - Roots of Polynomials. Galois theory: Elements of Galois theory, Solvability of radicals. Linear Transformations: Canonical forms, Nilpotent transformations

### UNIT – II: REAL ANALYSIS

Limit, Continuity, types of discontinuities, infinite limits, function of bounded variation, elements of metric spaces. Reimann Integral - Fundamental theorem of calculus - mean value theorem. Reimann - Stieltjes Integral, Infinite series and infinite products, sequences of functions, Fourier series and Fourier Integrals. Outer measure, measurable sets and Lebesque measures, measurable functions. Littlewoods three principles. Lebesque Integral of bounded function over a set of finite measure. Integration of a non negative function. General Lebesque Integral.

### UNIT – III: COMPLEX ANALYSIS

Local properties of analytic functions - Removable singularities Taylor's theorem - Zeros and poles, local mapping - maximum principle - Harmonic functions - Definitions & basic properties - mean value property - Poission's formula - Schwarz's theorem - reflection principle - power series expansions - Weierstrassis theorem - Taylor's series, Laurents series.

## UNIT – IV: TOPOLOGY AND FUNCTIONAL ANALYSIS

Topological spaces & continuous functions, metric topology, Connectedness, compactness, countability and separation axiom, Fundamental group and covering spaces.

Fundamentals of normed Linear spaces, bounded Linear maps on Banach spaces, open mapping theorem, converse of Reimann Lebseque Lemma, spaces of bounded linear maps, weak and weak convergence, compact linear maps, geometry of Hilbert space, Approximation and optimisation, Bounded operators of Hilbert spares, spectrum of bounded operators on Hilbert spaces.

## UNIT – V: DIFFERENTIAL EQUATIONS

Linear differential equations of higher order - Linear dependence and Wronskian basic theory - solutions in power series - Introduction to second order linear equations with ordinary points. Legendre equations and legender polynomial, Second order equations with regular singular points, Bessel equations. Partial differential equations; first order, complete Integral, general Integral, singular Integral, Compatible systems of first order equation, charpit's method. Partial differential equations of second order - Linear and partial equations with constant co-efficients Laplace equation - Elementary solutions of Laplace equation.

## ECONOMICS
## UNIT – VI

Importance and Scope of Economics - Micro and Macro Economics – Economic Statics and dynamics - Interdependence- Theory of Demand- Elasticity of demand: Types and Measurement - Uses and difficulties - Theory of consumer behaviour - Indifference curve analysis - Consumer's surplus.

Theory of production: Iso-quants – Producer's equilibrium- Production function – Types of Production function- optimum factor combination - Price and output determination under different market structures – Producer's Surplus.

General Equilibrium analysis and Welfare Economics – Welfare Criteria - Scitovsky's Paradox – Arrow's impossibility theorem – Rawl's theory of social justice -  Input output analysis.

## UNIT - VII

National income - Measurement - difficulties - Circular flow of income –Classical Theory of income and employment - Keynesian Analysis - Theory of aggregate demand and aggregate supply – IS - LM model - Absolute income hypothesis - Relative income hypothesis - Permanent income hypothesis – Consumption Function and Investment Function- Multiplier – Accelerator – Business cycles.

Economic Systems – Socialism- Capitalism- Market economy - Command economy - Mixed economy.

## UNIT - VIII

Money - Friedman's theory - Don Patikin's theory – Tobin's theory – Baumol's model - Inflation - Deflation - Causes - effects - measure to Control. Banking - Importance - Role and functions of Commercial Banks and Central Bank – Money Supply in India.

Composition and direction of foreign trade - Importance of of foreign trade and economic development - Balance of payments - Terms of trade – Foreign direct investment – Exchange rate - EXIM policy - GATT - WTO - Dunkel Draft - TRIPS - TRIMS – FEMA - UNCTAD, - International Financial Institutions - IBRD and IMF - New International Economic Order.

## UNIT - IX

Fiscal Function - Direct and Indirect taxes - Public Expenditure - Public borrowing - techniques - Debt management - Fiscal Federalism - Fiscal policy – Compensatory and Functional finance - Types of budget - Budget formulation - Centre and State Financial Relations in India.

## UNIT – X

Economic Development - Approaches to economic development - Adamsmith - Ricardo - Malthus - Schumpeter - Karl Marx - Gandhiji - J.C.Kumarappa - Periyar – Ambedkar Ideas-Leading development issues in India and Tamil Nadu - Economic and non - economic factors - Agriculture - Prospects and problems – Trends in agricultural productivity – Green Revolution - Land reform and effects - Rural Industrialization - Industry - Role of private and public Sectors - Industrial labour - Labour legislation - Social security measures.

Planning – Types of Planning - National and state objectives - achievements – Models adopted in Indian plans - New Economic Policy – Liberalization - Privatisation and Globalization Multi - National Corporations - Sustainable Development(Transition from MDGs to SDGs).

# FOR THE POST OF RESEARCH OFFICER AND

# RESEARCH ASSISTANT IN THE OFFICE OF THE COMMISSION

## GENERAL STUDIES
## (DEGREE STANDARD)

### TOPICS FOR OBJECTIVE TYPE

**SUBJECT CODE: 309**

### UNIT – I: General Science

**Physics** - Universe - General Scientific laws - Scientific instruments - Inventions and discoveries - National scientific laboratories - Science glossary-Mechanics and properties of matter-Physical quantities, standards and units-Force, motion and energy-electricity and Magnetism - electronics & communications - Heat, light and sound-Atomic and nuclear physics-Solid State Physics-Spectroscopy – Geophysics - Astronomy and space science.

**Chemistry -** Elements and Compounds-Acids, bases and salts - Oxidation and reduction – Chemistry of ores and metals -Carbon, nitrogen and their compounds- Fertilizers, pesticides, insecticides-Biochemistry and biotechnology-Electrochemistry- Polymers and plastics.

**Botany -** Main Concepts of life science-The cell-basic unit of life-Classification of living organism-Nutrition and dietetics-Respiration-Excretion of metabolic waste-Bio-communication.

**Zoology -** Blood and blood circulation-Endocrine system-Reproductive system-Genetics the science of heredity-Environment, ecology, health and hygiene, Bio-diversity and its conservation-Human diseases, prevention and remedies-Communicable diseases and non- communicable diseases-Alcoholism and drug abuse-Animals, plants and human life.


### UNIT - II: Current Events

**History -** Latest diary of events – National - National symbols -Profile of States- Defence, national security and terrorism-World organizations-pacts and summits- Eminent persons & places in news-Sports & games-Books & authors -Awards & Honours-Cultural panorama-Latest historical events- India and its neighbours- Latest terminology-Appointments-who is who?

**Political Science -** India's foreign policy - Latest court verdicts – public opinion - Problems in conduct of public elections- Political parties and political system in India-Public awareness & General administration- Role of Voluntary organizations & Govt.,-Welfare oriented govt. schemes, their utility.

**Geography -** Geographical landmarks-Policy on environment and ecology.

**Economics-** Current socio-economic problems-New economic policy & Govt. sector.

**Science -** Latest inventions on science & technology - Latest discoveries in Health Science - Mass media & communication.

**UNIT – III: Geography -** Earth and Universe - Solar system - Atmosphere hydrosphere, lithosphere -Monsoon, rainfall, weather and climate - Water resources - rivers in India - Soil, minerals & natural resources-Natural vegetation-Forest & wildlife-Agricultural pattern, livestock & fisheries-Transport & communication-Social geography – population-density and distribution-Natural calamities – disaster management-Climate change - impact and consequences - mitigation measures-Pollution Control.

**UNIT – IV: History and culture of India -** Pre-historic events -Indus valley civilization-Vedic, Aryan and Sangam age-Maurya dynasty-Buddhism and Jainism-Guptas, Delhi Sultans, Mughals and Marathas-Age of Vijayanagaram and the bahmanis-South Indian history-Culture and Heritage of Tamil people-Advent of European invasion-Expansion and consolidation of British rule-Effect of British rule on socio-economic factors-Social reforms and religious movements-India since independence-Characteristics of Indian culture-Unity in diversity –race, colour, language, custom-India-as secular state-Organizations for fine arts, dance, drama, music-Growth of rationalist, Dravidian movement in TN-Political parties and populist schemes – Prominent personalities in the various spheres – Arts, Science, literature and Philosophy – Mother Teresa, Swami Vivekananda, Pandit Ravishankar , M.S.Subbulakshmi, Rukmani Arundel and J.Krishnamoorthy etc.

**UNIT – V : INDIAN POLITY -** Constitution of India - Preamble to the constitution - Salient features of constitution - Union, State and territory - Citizenship-rights amend duties - Fundamental rights - Fundamental duties - Human rights charter - Union legislature – Parliament - State executive - State Legislature – assembly - Status of

Jammu & Kashmir - Local government – panchayat raj – Tamil Nadu - Judiciary in India – Rule of law/Due process of law - Indian federalism – center – state relations - Emergency provisions - Civil services in India - Administrative challenges in a welfare state - Complexities of district administration - Elections - Election Commission Union and State - Official language and Schedule-VIII - Amendments to constitution - Schedules to constitution - Administrative reforms & tribunals- Corruption in public life - Anti-corruption measures – Central Vigilance Commission, lok-adalats, Ombudsman, Comptroller and Auditor General of India. - Right to information - Central and State Commission - Empowerment of women- Voluntary organizations and public grievances redressal - Consumer protection forms.

**UNIT – VI: INDIAN ECONOMY -** Nature of Indian economy - Five-year plan models-an assessment - Land reforms & agriculture - Application of science in agriculture -Industrial growth - Capital formation and investment-Role of public sector & disinvestment-Development of infrastructure- National income - Public finance & fiscal policy - Price policy & public distribution- Banking, money & monetary policy - Role of Foreign Direct Investment (FDI) - WTO-globalization & privatization - Rural welfare oriented programmes - Social sector problems – population, education, health, employment, poverty - HRD – sustainable economic growth- Economic trends in Tamil Nadu - Energy Different sources and development - Finance Commission - Planning Commission - National Development Council.

**UNIT – VII: INDIAN NATIONAL MOVEMENT -** National renaissance- Early uprising against British rule-1857 Revolt- Indian National Congress - Emergence of national leaders- Gandhi, Nehru, Tagore, Netaji -Growth of militant movements - Different modes of agitations-Era of different Acts & Pacts-World war & final phase struggle - Communalism led to partition- Role of Tamil Nadu in freedom struggle - Rajaji, VOC, Periyar, Bharathiar & Others - Birth of political parties /political system in India since independence.

**UNIT – VIII : APTITUDE & MENTAL ABILITY TEST -** Conversion of information to data - Collection, compilation and presentation of data - Tables, graphs, diagrams-Parametric representation of data-Analytical interpretation of data -Simplification-Percentage-Highest Common Factor (HCF)-Lowest Common Multiple (LCM)-Ratio and

Proportion-Simple interest-Compound interest-Area-Volume-Time and Work-Behavioral ability - Basic terms, Communications in information technology - Application of Information and Communication Technology (ICT) - Decision making and problem solving.

**Logical Reasoning:** Puzzles – Dice - Visual Reasoning- Alpha numeric Reasoning- Number Series - Logical Number/Alphabetical/Diagrammatic Sequences.

….